a sensible deviation observed in the plumb-line between Milan and Genoa, by E G. Celoria.—On a hitherto neglected sulcus or depression frequently occurring in the frontal bone of the human skull between the boss and the temporal eminence, by Prof. G. Zoja.

March 20.—Obituary notice of the late Quintino Sella, by Prof. T. Taramelli.—Memoir on Antonio Angeloni Barbiani and his literary productions, by E. B. Prina.—Biological notice of *Alosa vulgaris* and *Salmo carpio*, inhabiting the Italian and sub-Alpine lakes, by Prof. P. Pavesi.—On the complete integers of some classes of partially derived equations of any order with two independent variants, by Prof. G. Pennacchietti.—Note on the quantitative determination of alogenous bodies, by P. Ritter-Zähony.—On the two human parasites *Anguillula intestinalis* and *A. stercoralis*, by E. C. Golgi and A. Monti.—Absolute values of the magnetic elements in Milan for the year 1883, by Dr. Ciro Chistoni.

Rivista Scientifico-Industriale, March 15.—Note on Wroblewski's experimental studies on the liquidation of hydrogen.—On the variation in the electric resistance of solid and pure metallic wires according to the temperature, by Prof. Angelo Emo.—On the pretended spontaneous combination of oxygen and hydrogen without increase of temperature effected by the exclusion of light, by L. Ricciardi.—On the migration of *Fuligula rufina* and *Erismatura leucocephala*, Scop., by Dante Roster.

Atti della R. Accademia dei Lincei, March 2.—Report on Alfredo Capelli's monograph on the composition of the groups of substitutions, by S. Battaglini.—Report on Prof. G. Bellonci's memoir on blastopore and the primitive line of the vertebrates, by S. Todaro.—Remarks on a group of curves of the fourth order, by Francesco Brioschi.—An experimental refutation of the hypothesis that every double link between carbon and carbon causes an increase of molecular refraction by a constant quantity, by Rodolfo Nasini.—On the stratification of the serpentine rocks in the Apennines, part i., by Torquato Taramelli.—Note on barometric hypsometry, by Aurelio Lugli.

March 16.—Obituary notice of the late Quintino Sella, by S. Maggiorani.—Meteorological observations at the Observatory of the Campidoglio during the months of January and February.

March 23.—On some unpublished and unknown works of Bartolomeo Marliani, by Enrico Narducci.—A chemical analysis of some brass and bronze objects found at the lacustrine station of Benaco, in Lombardy, by Luigi Pigorini.—Report on the antiquities discovered in various parts of Italy during the month of February 1884, by S. Fiorelli.—On barometric hypsometry, second note, by S. Tacchini.—Absolute values of the magnetic elements in Rome for the year 1883, by S. Tacchini.—On the stratification of the serpentine rocks in the Apennines, part ii., by Torquato Taramelli.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 3.—"Spectroscopic Studies on Gaseous Explosions." By Professors Liveing and Dewar.

Having occasion to observe the spectrum of the flash of a mixture of hydrogen and oxygen fired in a Cavendish eudiometer, the authors were struck by the brightness, not only of the ubiquitous yellow sodium line, but of the blue calcium line and the orange and green bands of lime, as well as of other limes which were not identified. The eudiometer being at first clean and dry, the calcium must be derived either from the glass or from some spray of the water over which the gases with which the eudiometer was filled had been confined. It seemed incredible that the momentary flash should detach and light up lime from the glass, but subsequent observations have pointed to that conclusion. Experiments were subsequently made on the flash of the combining gases inclosed in an iron tube, half an inch in diameter and about three feet long, closed at one end with a plate of quartz, held in its place by a screw-cap and made tight by leaden washers.

The tube was placed so that its axis might be in line with the axis of the collimator of a spectroscope, and the flash observed as it travelled along the tube.

It was seen at once that more lines made their appearance in the iron tube than in the glass vessel, and one conspicuous line in the green was identified in position with the E line of the solar spectrum. Several other lines were identified with lines of iron by comparison with an electric spark between iron electrodes. There could be no doubt that the flash in an iron tube gave several of the spectral lines of iron. The authors supposed that this must be due to particles of oxide shaken off the iron by the explosion, and proceeded to try the effect of introducing various substances in fine powder, and compounds, such as oxalates, which would give fine powders by their decomposition in the heat of the flame. Several interesting observations were made in this way. When some lithium carbonate was introduced, not only were the red, orange, and blue lines of lithium very brilliant, but the green line hardly less so. After the lithium had once been introduced into the tube, the lithium lines continued to make their appearance even after the tube had been repeatedly washed. When the lithium had been freshly put in, the red line was observed to be much expanded, very much broader than the line given by lithium in a Bunsen burner reflected into the slit for comparison. The light was dazzling unless the slit was very narrow; and it was noticed that if the spark by which the gas was fired was at the distant end of the tube, so that the flame travelled along the tube towards the slit, there was a reversal of the red line; a fine dark line was plainly visible in the middle of the band. When the spark was at the end of the tube next the slit, no reversal was, in general, seen. Later observations showed that some other metallic lines might be reversed in this way, and photographs taken of the reversals. These observations with the eye on the reversal of the red lithium line were made with a diffraction grating, and were repeated many times. They show that there are gradations of temperature in the flame, and that the front of the advancing wave of explosion is somewhat cooler than the following part. The combination of the gases is not so instantaneous that the maximum temperature is reached at once. When some magnesia was put into the tube the continuous spectrum was very bright, but the iron lines were still brighter. No line which could be identified as due to magnesium was observed with certainty; there was only a doubtful appearance of *b*. With sodium, potassium, and barium carbonates, only the lines usually seen when salts of those metals are introduced into a flame were noticed; but eye observations of this kind are extremely trying, on account of the suddenness of the flash and the shortness of its duration. Thallium gave the usual green line.

Subsequently the interior of the tube was bored out so as to present a smooth bright surface of iron, and the iron lines which were conspicuous in the flash were noted.

For the purpose of identification the pointer in the eye-piece was first placed on one of the strong iron lines given by the electric discharge between iron electrodes, and then, the discharge being stopped but the field sufficiently illuminated, the eye was fixed steadily on the pointer while the gas in the tube was exploded. In this way it was not difficult to see whether any given line was very bright in the flash. The lines thus identified were those having the wave-lengths about 5455, 5446, 5403, 5396, 5371, 5327, 5269 (E), 5167 (*b*4). These lines were all many times observed in the way described, and as a rule were always present in the flash. Lines with wave-lengths about 5139 and 4352 were seen, and may possibly have been due to iron, and several more lines were seen occasionally, but were not so regularly seen that they could be well identified. The lines λ 4923 and λ 4919 were specially looked for, but neither of them could be seen. A group of blue lines were noticed, and were afterwards identified by photography, a method much less trying than observations by eye. To give intensity to the photographs ten or twelve flashes were usually taken in succession without any shift of the instrument, so as to accumulate their effects in one photograph. For identification the spark between iron electrodes was also photographed, but with a shutter over the lower part of the slit, so that the image of the spark should occupy only the upper part of the field.

Some sixty of the iron lines in the indigo, violet, and ultra-violet were thus photographed.

As a rule no iron lines above O make their appearance; in a few plates T is visible, and it is possible that other lines may be obscured by the water spectrum, which always comes out and extends from near *s* to below R. Above T no line at all is visible in any of the photographs, though the spark lines come out strongly enough, and several of the strongest groups of iron lines, both of spark and arc lines, are in the region beyond T.

Other experiments were made with explosions of carbonic oxide and oxygen, and with coal-gas and oxygen. The explosions of these gases were attended with much more continuous spectrum, and the metallic lines were not always as well developed as they were with hydrogen and oxygen, but on the whole there were as many metallic lines photographed from the flashes of carbonic oxide as from those of hydrogen.

When the iron tube was lined with copper foil, only one copper line in the visible spectrum, λ 5105, was seen, and in the ultra-violet two lines, λ 3272 and λ 3245·5. All three lines were very strong, and the two ultra-violet lines were in some cases reversed. These lines were also frequently developed when no copper lining was in the tube, probably from the brass of the small side tubes.

Copper also gave a line in the indigo, λ 4281 about, decidedly less refrangible than the copper line, λ 4275, coincident apparently with the strong edge of one of the bands developed when a copper salt is held in a Bunsen burner.

A lining of copper which had been electro-plated with nickel developed only one nickel line, λ 5476, in the visible part of the spectrum, but gave by photography twenty-five lines in the ultra-violet.

When copper wire electro-plated with cobalt was put into the tube twenty-two cobalt lines in the violet and beyond were photographed.

No other metal gave anything like the number of lines that were given by iron, nickel, and cobalt.

A lining of lead gave the lines λ 4058, 3683, and 3639 strongly, and these lines were frequently developed, though less strongly, when there was no lead lining; the metal being without doubt derived from the leaden washers used to make the ends of the tube air-tight.

A strip of silver gave the lines λ 3381·5 and 3278, and these lines were sometimes reversed. No trace of the channelled spectrum of silver was developed even when silver oxalate was put into the tube, and furnished plenty of silver dust after the first explosion.

A magnesium wire about 2 millims. thick and two-thirds the length of the tube gave the *b* lines very well; that is to say b_1 and b_2 were well developed, and b_4 was also seen, but as the iron and magnesium components of b_4 are very close together, and the iron line had been observed before the introduction of the magnesium, it was not possible to say with certainty whether or not the magnesium line were present too. No other magnesium line could be detected. The blue flame line was carefully looked for, but could not be seen. The photographs showed none of the magnesium triplets in the ultra-violet, nor any trace of the strong line λ 2852, which appears in the flame of burning magnesium, and is yet more conspicuous in the arc when that metal is present.

Metallic manganese, introduced into the tube in coarse powder, gave the group at wave length about 4029 with much intensity, but no other manganese line with certainty. In the visible part of the spectrum the channellings in the green due to the oxide were visible.

A lining of zinc produced no zinc line, and zinc-dust gave only a very doubtful photographic impression of the line λ 3342. A strip of cadmium gave no line of that metal either in the visible or in the ultra-violet part of the spectrum.

Tin, aluminium, bismuth, and antimony, also failed to produce a line of any of those substances, and so did mercury which was spread over copper foil made to line the tube.

Thallium spread as amalgam over the copper lining gave the lines λ 3775·6, 3528·3 and 3517·8.

Chromium was introduced as ammonium bichromate, which of course left the oxide after the first explosion. This gave the chromium lines with wave-lengths about 5208, 5205, 5204, 4289, 4274·5, 4253·5, very well and persistently, also the lines with wave-lengths about 3605, 3592·5, 3578·5.

Sodium salts (carbonate, chloride) developed the ultra-violet line λ 3301; and potassium salts give the pair of lines about wave-length 3445; but no more refrangible line of either metal was depicted on the photographs. Lithium carbonate gave, besides the lines in the red, orange, green, and blue, the violet line, λ 4135·5; but no more refrangible line.

Photographs of a flame of mixed coal-gas and oxygen, in which an iron wire was burnt, show, as might be expected, the same iron lines as are developed in the flash of the detonating gases, and of the same relative intensities. These intensities are not quite the same relatively as they are in the arc spectrum. Thus the lines λ 3859, 3745, 3737, 3735, and 3719 come out in great strength, much stronger than the lines λ 3647, 3631, 3618, which are remarkably strong in the arc.

German-silver wire, burnt in the flame of coal-gas and oxygen, gave the same nickel lines as were given by nickel in the detonating gases, as well as those of copper and lead.

Copper wire gave, besides the lines λ 3272, 3245·5, a set of bands in the blue, which correspond with those given by copper salts in flames, and are probably due to the oxide.

The greater part of the lines observed in the flames of the exploding gases have been observed by the authors to be reversed when the several metals were introduced into the arc in a crucible of lime or magnesia; which is quite in accord with the supposition that the metals experimented on are volatile, and emit as well as absorb these particular rays, at temperatures lower than that of the arc.

That iron is volatile at a temperature below the fusing point of platinum, which is about 1700° C., has been pointed out by Watts (*Phil. Mag.*, vol. xlv. p. 86), who observed in the flame of a Bessemer converter almost all the green and blue lines of iron which we have seen in the exploding gases, besides one or two lines which we have not observed or identified. Having regard to this volatility of iron, it does not seem so surprising that iron lines should be observed accompanying those of hydrogen to great heights in the sun's atmosphere as that they should not be always seen there.

Copeland (Copernicus, December, 1882) observed in the spectrum of the great comet of 1882 four lines nearly identical with four of the green lines of iron seen in the detonating gas.

It is remarkable that such volatile metals as mercury, zinc, and cadmium should give no lines in the flame of the exploding gases.

The absence of any metallic lines more refrangible than T in the flame of the exploding gases may be in part due to a falling off in the sensibility of the photographic plates for light of shorter wave-lengths; but as the spark lines of iron seem to be quite as strongly depicted on the plates in regions of the spectrum far above T as they are in the regions below, want of sensitiveness in the plates cannot be the only reason for the absence of higher lines, but probably the emissive power of the metals for these lines is feeble at the comparatively low temperature of the flame.

Gouy (*Comp. R.*, 1877, p. 232), using a modification of Bunsen's burner fed with gas mixed with spray of metallic salts, observed at the point of the inner green flame three or four iron lines which have not been observed in the flame of the detonating gas, the lines b_1 and b_2 of magnesium, two cobalt lines in the blue which are not seen in the detonating gas, one line of zinc, and one of cadmium, and the two strong green rays of silver. Can the appearance of these rays under these circumstances imply that the temperature of the inner green cone of a Bunsen burner, when the proportion of air to coal-gas is near the exploding point, is higher than that of the explosion of hydrogen and oxygen?

The interesting theoretical questions which are suggested by the facts recorded in this paper the authors leave for further discussion.

Linnean Society, April 17.—Alfred W. Bennett, M.A., in the chair.—Messrs. R. Lloyd Patterson and Benjamin Lomax were elected Fellows.—Dr. J. Poland exhibited under the microscope a series of preparations, stained by reagents, illustrating the *Bacillus* of anthrax of man. He remarked on the severely fatal character of the malady, not only in this country but on the Continent and certain places abroad. The *Bacillus*-spores were in many instances doubtless conveyed in the dried skins and hides imported from abroad, and under favourable conditions inoculated those handling the dried hides, &c., the germs developing in the usual manner of the low vegetable organisms.—Dr. R. C. A. Prior drew attention to specimens of *Draba aizoides* obtained from Pennard Castle, Swansea, said to be the only locality where this plant grows wild in England.—The ninth contribution to the ornithology of New Guinea, by Mr. R. Bowdler Sharpe, was read, and it dealt with some few birds obtained by Mr. A. Goldie in the Astrolabe Mountains.—A paper was read by the Rev. J. M. Crombie on the algo-lichen-fungal hypothesis. The author gave a brief sketch of the hypothesis as enunciated by Schwendener, Bornet, and others, noticing the various arguments and illustrations which had been adduced in its support. He then discussed the result which had been obtained from experiments in lichen-culture, whether from the spore or by synthesis—observing that in both cases these were confessedly but small, owing to the very great difficulty of cultivating beyond a rudimentary stage except under the same atmospherical conditions in which they grow in nature. Two fatal objections he said might be taken to the theory: (1) the one having reference to the very peculiar nature of the parasitism it assumed, and the other (2) to the fact that notwithstanding a similarity of appearance there were in reality no true fungal-mycelia nor true algal-colonies in lichens. As to any direct genetic or any indirect parasitical connection between the gonidia of lichens and the hyphal filament, it was further pointed out that none such existed, but that on tracing the evolution of the thallus from the germinating spore, it is seen that the gonidia originate in the cellules of the first parenchymatous tissue formed upon the hypothallus, and that subsequently through the resorption of the lower portion of the cortical stratum they became free, and constituted the thin gonidial stratum. Where seen lying amongst the medullary hyphæ they are often attached to these, not as the result of any copulation, but by means of the lichenin which permeates the whole thallus. The origin of the gonidia and their relation to the rest of the lichen thallus, the author stated in conclusion, thus belonged to the very elements of morphological botany.—There followed a note on a remarkable variation in the leaf of *Banksia marginata* observed by Mr. J. G. Otto Tepper in South Australia; and he questions whether this might not be regarded as the spontaneous production of a new variety or species or the remnant of an extinct form.—Mr. R. A. Rolfe then discoursed on *Hyalocalyx*, a new genus of Turneraceæ from Madagascar. According to Dr. J. Urban (the latest authority) the order consists of five genera and eighty-three species distributed in America from North Carolina and Mexico to the Argentine Republic, and in Africa from Abyssinia to Mozambique and the Cape of Good Hope, while outliers are found in the islands of Zanzibar and Rodriguez. The unique example now added was obtained by Dr. C. Rutenberg on Nossi-bé, a small island on the north-west of Madagascar. Its peculiarities incline Mr. Rolfe to regard it as the type of a new genus with a position between *Mathurina* and *Turnera;* its most remarkable character being its glassy transparent calyx totally destitute of chlorophyll.

Chemical Society, April 17.—Dr. Perkin, F.R.S., president, in the chair.—A ballot was held, and the following gentlemen were elected Fellows:—W. D. Borland, J. C. Bose, W. D. Crumbie, A. F. Dimmock, H. G. Greenish, W. J. Grey, J. Gaskell, J. W. Pratt, A. G. Perkin, W. H. Perkin (jun.), G. H. Wainwright.—The following papers were read:—On the influence of incombustible diluents on the illuminating power of ethylene, by P. F. Frankland. Mixture of ethylene with carbonic anhydride, nitrogen, aqueous vapour, and air, have a lower illuminating power than pure ethylene. Mixtures with oxygen have a greater illuminating power than pure ethylene; carbonic anhydride is the most and air the least prejudicial to the illuminating power.—On trichloropyrogallol, by C. S. S. Webster. The author has prepared mairogallol by the method of Stenhouse and Groves. He finds that the reaction can be separated into two stages, in the first of which trichloropyrogallol is formed. Its reactions are identical with tribromopyrogallol. The author confirms the statements of Stenhouse and Groves in almost every particular.—The synthesis of galena by means of thiocarbamide, by J. Emerson Reynolds. The author has succeeded in coating glass vessels, brass tubes, &c., with a nitrous galenoid coating, by the decomposition of an alkaline solution of lead tartrate with sulphur urea.—On the analysis of Woodall Spa, by W. T. Wright. This spring contains a large amount of bromine (49·7 parts per million) and iodine (5·21 per million); it is much richer in these elements than any other spring in this country.—On the critical temperature of heptane, by T. E. Thorpe and A. W. Rücker. By calculation it is found to be about 281°.

SYDNEY

Linnean Society of New South Wales, February 27.—The following papers were read:—Monograph of the Australian sponges, by R. von Lendenfeld, Ph.D., part 1. This paper is introductory to a monograph upon the Australian sponges, large materials for which have already been accumulated by the author, partly from his own collections, and partly from those in the Museums of Christchurch and Dunedin, New Zealand, and of Adelaide, South Australia. The real investigation of this branch of the Cœlenterata may be said to begin with the work of Grant, 1826; to have risen to a new and much higher level under Schulze, 1875-1881, and to have been continued by Lollas, Keller, Vosmaer, Marshall, the author, and others, with continually increasing success up to the present time. A sufficient account of the bibliography of the Spongida is presented in this paper to enable those interested to find any desired information upon the subject, a matter of no small difficulty at present.—The *Scyphomedusæ* of the southern hemisphere, by R. von Lendenfeld, Ph.D., part 1. The *Scyphomedusæ* or "jelly-fish" appear to be more numerous in the southern than in the northern hemisphere. Of the 210 known species, 104 have already been found in the former, and as the animals of that hemisphere are not nearly so well known as those of the northern, the number of southern species must doubtless be much greater than that mentioned. Only twenty-six of the 104 southern species are Australian, but this apparent poverty of the Medusæ of our shores is due to the limited investigation that has been made. In this paper all the species of this hemisphere are described.—Notices of some new fishes by William Macleay, F.L.S. Four species are here described. Two of them, *Platycephalus longispinis* and *Urolophus bucculentus* were taken in the trawl in deep water outside the Heads of Port Jackson. The third, *Petroscirtes wilsoni*, was found by Mr. J. D. Wilson at the North Shore; and the fourth, *Athirinosoma jamiesoni*, was a small freshwater fish from the Bæmer, one of the head waters of the Brisbane River.—On the improvement effected by the Australian climate, soil, and culture on the Merino sheep, by P. N. Trebeck. In this paper Mr. Trebeck traces the changes and improvement which wool has undergone in Australia since the first introduction of German and Silesian sheep. Samples of the wool of all the periods and flocks alluded to were exhibited. Mr. Trebeck concludes his paper by stating his opinion that the whole of the country on our western watershed was eminently suitable for the Merino sheep, and that we only required the fostering assistance of an intelligent Government to keep in the front ranks of the wool-producing countries of the world.

CONTENTS

PAGE
The Edinburgh University Festival 593
Prjevalsky's Travels in Central Asia 593

Our Book Shelf:—

Jung's "Deutsche Kolonien" 594
"Catalogue de la Bibliothèque Japonaise de Nordenskjöld" 594

Letters to the Editor:—

The Dust of Krakatão.—**Prof. John W. Judd, F.R.S.; Prof. W. L. Goodwin** 595
"Earthquakes and Buildings."—**Dr. A. Ernst** . . 595
On the Transmission of Organic Germs through Cosmical Space by Meteoric Stones.—**J. H. Stewart** 595
Instinct of Magpies.—**Rev. James Graves** . . . 596
Cats at Victoria Station.—**Rooke Pennington** . . 596
Wild Duck laying in Rook's Nest.—**John Cordeaux** 596
Science and the Public Service.—S. 596
The Hong Kong Observatory. By **Dr. W. Doberck** 596
The Cedar Forest of Cyprus. By **Sir Robert Biddulph, K.C.M.G., C.B.** 597
Mineral Resources of the United States 598
The Late Dr. Engelmann. By **Dr. Maxwell T. Masters, F.R.S.** 599
Siwalik Carnivora (*With Illustrations*) 599
An Earthquake in England. By **Dr. J. E. Taylor; A. Percy Smith; Henry O. Forbes** 602
Notes 603

Our Astronomical Column:—

Southern Comets 606
The Observatory of Palermo 606
Geographical Notes 606
On the Progress of Geology. By **Prof. Julius von Haast, Ph.D., F.R.S.** 607
Dust-free Spaces. By **Dr. Oliver J. Lodge** (*With Illustrations*) 610
University and Educational Intelligence 613
Scientific Serials 613
Societies and Academies 614